Figure S.1. Plots of the contents of mobile elements [Na_2O and K_2O (wt%) and U (ppm)] vs. an immobile element (Nb) for lavas from O'Higgins Guyot, Alpha Seamount, Robinson Crusoe Island, and Alejandro Selkirk Island. The correlations indicate that even though low-temperature alteration may have affected the mobile elements (Na, K, and U), they can still be used with caution for petrogenetic interpretations (e.g., TAS diagram).

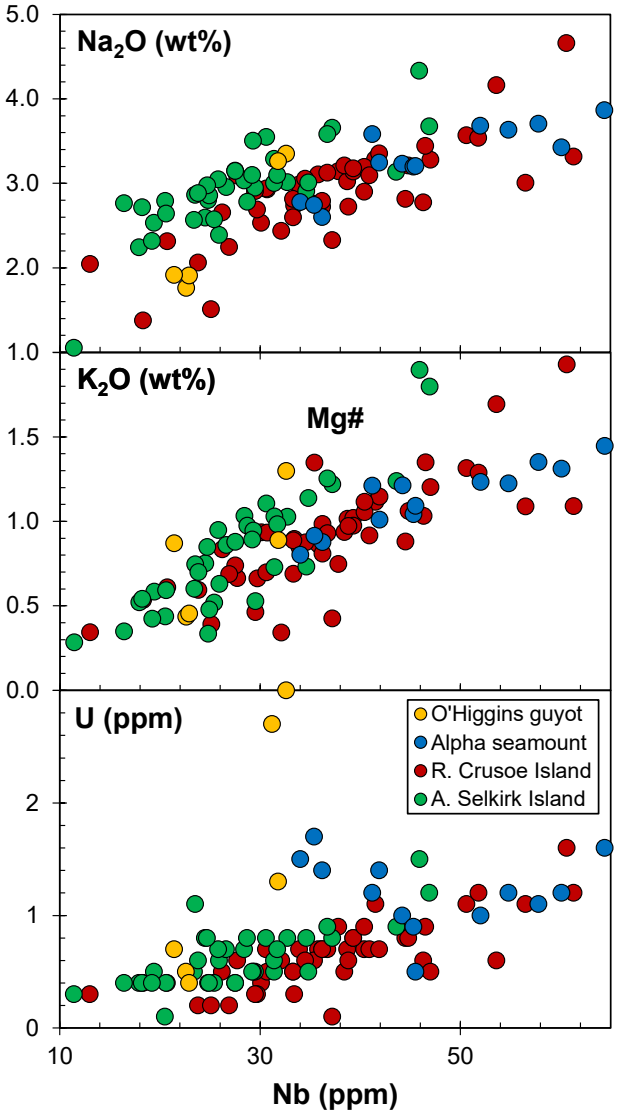

Figure S.2. Plots of Mg number (Mg#) vs. major elements ($Fe_2O_3^T$, TiO_2, Na_2O, Al_2O_3, K_2O, and P_2O_5) for JFR shield-stage lavas.

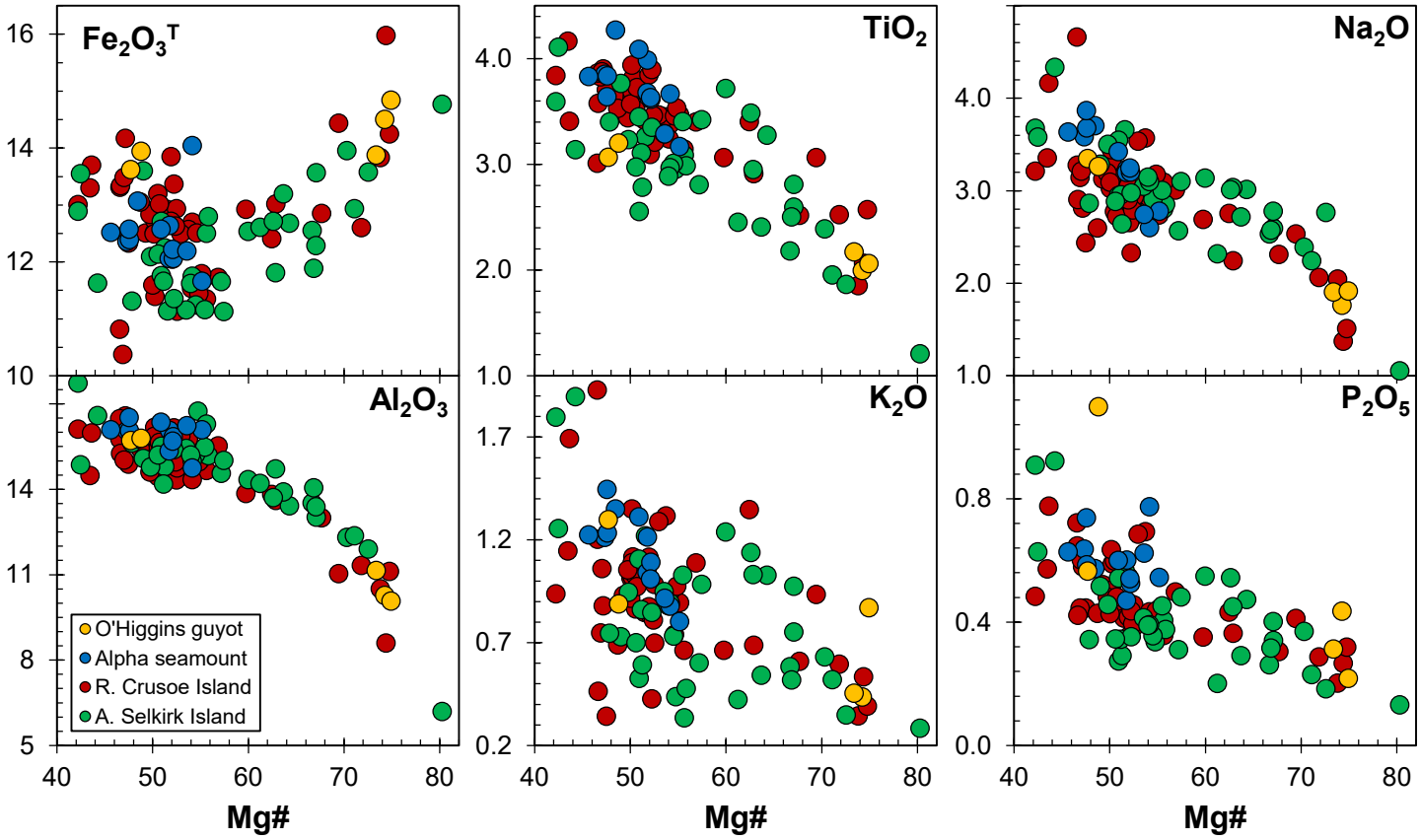

Figure S.3. Primitive mantle-normalized (PM from Sun and McDonough, 1989) patterns showing the abundance of incompatible elements for samples from the O'Higgins (yellow), Alpha (blue), Robinson Crusoe (red), and Alejandro Selkirk (green) volcanoes. The data reveal the relative chemical enrichment of Robinson Crusoe/Alpha samples with respect to Alejandro Selkirk/O'Higgins samples.

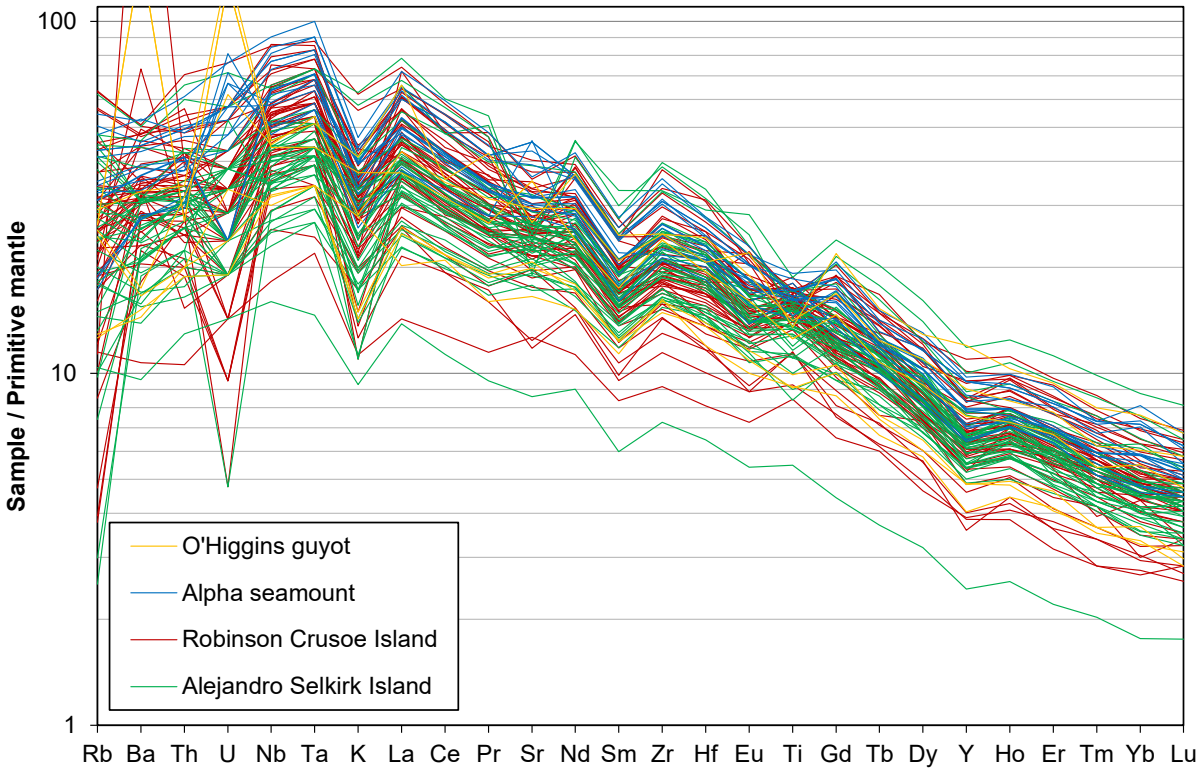

Figure S.4. Primitive mantle-normalized (PM from Sun and McDonough, 1989) patterns showing the trace-element contents of primitive melts from the Robinson Crusoe and Alejandro Selkirk Islands (red and green, respectively). Samples LL250711-7 and MF-6 represent a few samples with relatively low ratios of La/Yb and were modeled in OBS1 to evaluate the proposed model. See Figure 9 in the main text for details.